

PERFORMANCE ANALYSIS OF COMPRESSION IGNITION (CI) ENGINE USING BIO FUELS

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ABSTRACT

On a basic level, outflow diminishment of harmful substances in fumes gas of compression-ignition (CI) diesel engine can be accomplished at three spots: previously, in and after the CI engine. The normal approach is the presentation of reactant depletes frameworks, valve timing, fuel blend readiness and burning displaying, and also utilizing energizes, the synthetic synthesis of which gives the possibility to lessening. The last choice appears to be the least difficult; however it isn't really the main choice that would be taken into thought. Because of the distinctive properties of fuels, it is important to advance singular frameworks of the inner burning engine; else, it might happen that the lessening of discharges of dangerous substances is missing as a coveted impact, or, in the contrary outrageous, inadmissible execution of the engine may come about. This paper gives an elaboration on the utilization of bio fuels as rapeseed methyl esters - bio diesel, as far as execution and the requirement for improvement of singular frameworks on inward ignition engines. That is a precondition for the compelling utilization of bio energizes as the main fuel, and there is likewise a probability of advancing the engine framework keeping in mind the end goal to accomplish the most ideal relative execution on the off chance that both non-renewable energy source and bio fuel are utilized.

KEYWORDS: Efficiency, Exhaust Emission, Injection, Advance Angle & Bio Based Diesel Fuel EN14214

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1. INTRODUCTION

In the period of rising ecological consciousness of the all-inclusive community, compulsory arrangements revered in the enactment are gone for decreasing the emanation of harmful substances from the fumes of street vehicles to indisputably the base. Be that as it may, in doing this, we additionally need to safeguard the solace originating from the created energy of street vehicle engines (inside burning engines). Truly, with the presentation of purported assistant frameworks, vitality needs are ceaselessly expanding. There is a scope of exceptionally refined innovative arrangements, covering each fragment of engine development, utilized by constructors keeping in mind the end goal to ceaselessly diminish the levels of outflow of directed lethal substances from engine fumes. Fumes gas treatment is an imperative innovation in all street vehicles. Through the utilization of different sorts of exhaust systems, it enables us to diminish all discharges of lethal substances subject to directions. This innovation is generally simple to apply, by introducing it to the fumes framework; be that as it may, there are confinements too, noticeable in the way that, because of the deficiency of space in street vehicles, it is once in a while exceptionally hard to place such frameworks fittingly, and their effectiveness relies on the amount and substance of fumes gases. An extremely effective strategy for diminishing dangerous substance outflows from engine fumes of the CI engine is the purported ignition process administration, which principally relies upon the technique for

shaping the fuel blend. With regards to mechanical arrangements of that kind, we have to bring up high-weight fuel infusion frameworks (normal rail); charging frameworks for CI engine (turbo-compressors); frameworks managing the strategy for supplanting the working issue (variable planning of opening and shutting of gulf and fumes valves); development outline of channel and debilitate frameworks, and in addition burning chambers, with the point of diminishing the protection of stream, and centering the stream of the working liquid, with a specific end goal to accomplish as great a blend of fuel and air as could be expected under the circumstances. Development arrangements, and the utilization of proper oils, can impact the inside protection in CI engine to a noteworthy degree, in this way adding to the diminishing of vitality utilization, and, along these lines, fuel utilization also. The arrangements we have recently sketched out are essentially hampered by specific confinements. That can principally be found in the way that their application on officially existing IC engines is in fact inconceivable, or fiscally unfeasible. The arrangements that can be offered for existing IC engines depend on the utilization of elective fuels, and on enhancing engine task for that fuel. Be that as it may, there are contrasts between specific sorts of accessible elective energizes, and the potential for diminishing poisonous substance emanations from CI engine fumes relies on the source of a fuel (essential crude material utilized for acquiring the fuel), and upon the properties of that fuel. Especially intriguing are elective fuels with substances of natural inception as the essential crude material. On a fundamental level, the wellspring of such energizes is boundless, restrictively. Crude material utilized for the obtainment of biofuel can be constantly reestablished, and, over that, biofuel likewise favorably affects the emanation of unregulated carbon dioxide (CO₂) from the fumes of street vehicles, among its different properties. That implies that the improvement of advances for the obtainment of biofuels makes preconditions for the advancement of economy autonomous of unrefined petroleum (new occupations, advancement of new regions of economy, and so forth.), what's more, a positive effect on the earth is likewise accomplished. One normal for every single elective fuel is the way that CI engine parameters must be balanced for the utilization such energizes, so as to have the capacity to appropriately use the fuel potential. As a rule, a negligible substitution of customary fuel by an elective fuel may even outcome in the declining of poisonous substance discharges what's more, engine execution, which is unsuitable. This paper expounds on the trial inquire about went for deciding the execution of CI engine for overwhelming obligation vehicles, and on streamlining the key parameters of the engine when utilizing biofuel as the fundamental fuel, or as an expansion to petroleum derivative.

2. EXPERIMENTAL WORK

The exploration introduced in this paper depends on testing the CI engine with essential attributes laid out in Table 1. The tried engine was a utilized engine that had been utilized as a part of a city transport for the time of around 15 years before the testing. This engine is all the all the more intriguing for testing purposes, given the way that such engines are still in task in an extensive number of transports. The data outlined in Table 1 is the factory data, based on the use of fossil fuel conventional diesel fuel.

Table 1: Basic Parameters of the Tested Engine

Engine	4-Stroke, with MAN Fuel Injection
Number of cylinders	6
Piston bore and stroke	125 mm x 155 mm
Displacement	11.413 dm ³
Compression	18:1
Static injection timing	23°CA before TDC
Nominal power	160 kW / 2200 min ⁻¹
Torque	775 Nm / 1400 min ⁻¹

The test itself was directed on the proving ground for inner ignition engine testing, which was put in a satisfactory space (testing station), with connectors for all the required vitality sources. Engine activity over the span of the testing was overseen from the war room, which took into consideration optical deceivability of the tried engine amid the testing technique. All the hardware and frameworks for enlisting the level of estimated parameters were situated in the war room. The fundamental information on the test bed for CI engine testing is given in Table 2.

Table 2: Test Bed for CI Engine Testing

Brand / model	Zöllner / B – 350 AC
Type	Electric
Nominal torque	350 kW
Maximum rotation speed	6000 min ⁻¹

Based on the objectives of CI engine testing, the accompanying parameters and estimations were secured by the testing.

- CI engine rpm
- Stroke of fuel injector needle of the primary barrel
- CI engine torque (control at the brake)
- Air stream
- Fuel utilization every hour
- Humidity of encompassing air
- Fuel temperature, preceding the pump
- CO discharge
- Temperature of encompassing air
- NO_x outflow
- Water temperature at engine bay
- HC outflow
- Water temperature in engine square
- Soot in fumes gas
- Temperature of greasing up oil
- Barometric weight
- Temperature in fumes gas authority
- Air temperature in the separator quickly preceding engine gulf
- Pressure in the main engine chamber

- Pressure before the wind current meter
- Pressure in air separator right at the passageway to engine, preceding channel valve
- Pressure in high-weight pipe of the principal barrel, quickly in front of the injector
- Pressure drop at air channel
- Indication of TDC position

Based on chose components, it is conceivable to compute the essential parameters of CI engine, for example, control, particular fuel utilization, warm discharge qualities, start of real fuel push, and so forth. Or their esteems balanced for the state of the standard condition amid the testing time frame [1, 2, 3, 4, and 5]. Over the span of the testing, the accompanying powers were utilized: unadulterated mineral diesel fuel D2, comparing to the European standard EN 590; and unadulterated biodiesel fuel, relating to the necessities of the European standard EN 14214, delivered by the organization. The fundamental attributes of utilized fuels are appeared in Table 3.

Table 3: Diesel and Bio Diesel Properties

Fuel	Diesel	Biodiesel
Cinematic viscosity at 30 °C [mm ² /s]	3.34	5.51
Surface tension at 30 °C [N/m]	0.0255	0.028
Calorific value [kJ/kg]	43800	38177
Cetane number [-]	45-55	>51

Based on unmistakably unique physical properties of powers utilized, and based on information on the way of biodiesel ignition in CI engine, the planning of the fuel infusion begin was changed as a parameter went for the advancement of engine activity relying upon whether either sort of fuel is utilized. That is fundamentally associated with the way that the ignition timing interim is to some degree bring down for biodiesel (which can be connected with to some degree higher cetane number of biodiesel, when contrasted with diesel fuel) [6], and with the way that the procedure of fuel infusion is fairly unique (connected to the higher consistency of biodiesel) [7, 8]. The prescribed industrial facility estimation of 23°CA preceding TDC was taken as reference an incentive for infusion timing. Proving ground testing was performed for a generally extensive variety of infusion timing, which is, generally, constrained by the high-weight pump itself, or by the likelihood of modifying the pump. For each decided fuel infusion timing the testing was performed first with the regular diesel fuel, and afterward, for the same properties, with biodiesel fuel also. After looking at the got comes about, specific contrasts were noted, indicating the requirement for alteration of the fuel infusion framework, contingent upon the fuel utilized [9, 10&11]. Given the way that the tried CI engine, regardless of its moderately more seasoned plan, is still in business use, in the continuation of this paper we will give a review of comes about for the infusion timing that, in view of our decisions, gives ideal CI engine execution from the perspective of torque, power and fuel utilization, contingent upon whether fossil or biodiesel fuel is utilized, without the need to rearrange the infusion timing at the high-weight pump when changing from one fuel to the other.

3. EXPERIMENTAL RESULTS

As we have officially brought up in the past section, the testing of the CI engine with MAN fuel infusion system was performed for different infusion timing esteems, utilizing both diesel and biodiesel fuel in a specific administration. Given the way that power was kept at an around square with level when utilizing diesel or biodiesel fuel, with the distinction in the successful usage degree inside the bearable scope of 3 %, Figures 1 and 2 obviously demonstrate that the favorable position regarding fuel utilization, notwithstanding the fuel infusion timing, is in favor of diesel fuel. The higher

utilization of biodiesel fuel, in correlation with diesel fuel, is an outcome of its bring down warming worth [4, 8, 9], which implies that the conservation of CI engine power was accomplished by expanding the recurrent conveyance of fuel. On the off chance that one takes part in an examination of qualities talked about before, depending of fuel infusion timing, yet this time concentrating on one and a similar fuel, Figures 3 and 4 lead us to a reasonable conclusion that the abatement of infusion timing from 23 °CA to 21 °CA brings about an immaterial change to viable power P_e , or compelling torque M_e , both for biodiesel and diesel fuel use. The decision of talked about fuel infusion timing of 21°CA and 23°CA is a consequence of extensive research arrangement directed on the tried engine [10, 11, 12] with the point of deciding the ideal estimation of infusion timing, which would bring about greatest use of the advantages of biodiesel as engine fuel, while at the same time maintaining a strategic distance from the compounding of yield parameters of a similar engine when ordinary fossil diesel fuel is utilized. Based on that exploration [11], which incorporated the estimations of all the applicable parameters, for example, the stream of fuel furthermore, air, temperature of different liquids, weight at all trademark areas, and fumes gas outflows, the conclusion was that the ideal planning for the utilization of exclusively biodiesel fuel is 19°CA preceding TDC, while the planning of 21°CA gives the best impacts when the two kinds of fuel are utilized. Furthermore, estimations of the substance of fumes gases were performed too. The estimations affirmed that, when utilizing biodiesel fuel, CO and HC discharges are bring down contrasted with the utilization of diesel fuel, while NOx emanation is fairly higher [13].

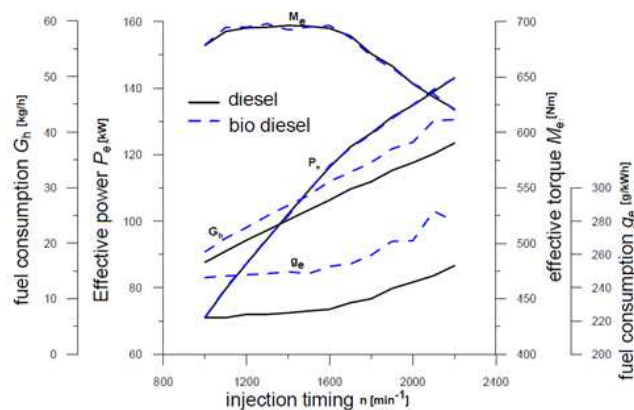


Figure 1: Effective Power P_e , Effective Torque M_e , Fuel Consumption G_h and Specific Fuel Consumption g_e for Use of Diesel and Bio Diesel Fuels with Injection Timing of 23°CA before TDC

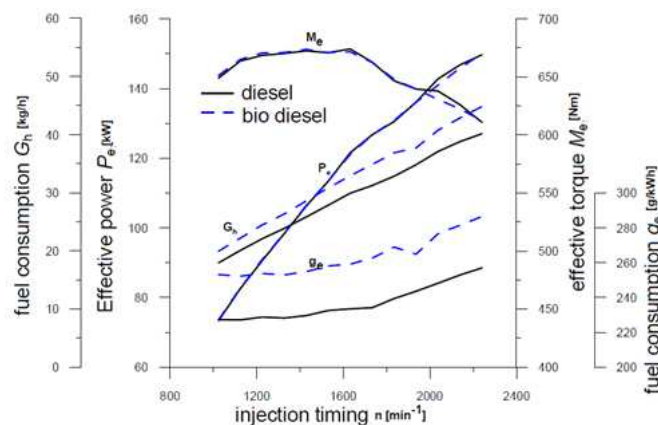


Figure 2: Effective Power P_e , Effective Torque M_e , Fuel Consumption G_h and Specific Fuel Consumption g_e for Use of Diesel and Bio Diesel Fuels with Injection Timing of 21°CA before TDC

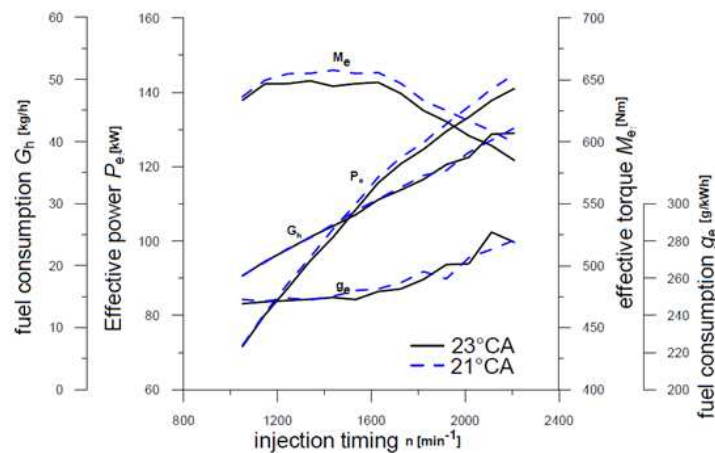


Figure 3: Effective Power P_e , Effective Torque M_e , Fuel Consumption G_h and Specific Fuel Consumption g_e for Use of Bio Diesel Fuel with Injection Timing of 21°C CA and 23°C CA before TDC

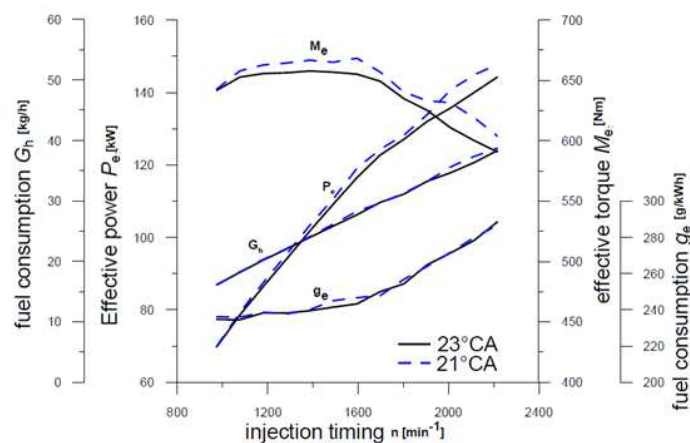


Figure 4: Effective Power P_e , Effective Torque M_e , Fuel Consumption G_h and Specific Fuel Consumption g_e for Use of Diesel Fuel with Injection Timing of 21°C CA and 23°C CA before TDC

4. CONCLUSIONS

This paper has introduced the consequences of testing the impact of fundamental CI engine parameters on engine execution, essentially from the perspective of energy, torque furthermore, fuel utilization, when utilizing fossil diesel fuel, and biodiesel fuel as a sustainable power source. We can reason that the greatest effect is delivered by the fuel infusion timing, as a parameter that is generally simple to modify without coordinate development intercessions on the CI engine. Due to the obviously unique physical properties, there are additionally phenomenological contrasts during the time spent fuel conveyance and fuel utilization; in this way, it is important to locate an ideal level for the infusion timing parameter when utilizing just a single fuel compose, or the two kinds. By diminishing the production line prescribed fuel infusion timing, one can enhance CI engine execution when utilizing biodiesel, accomplishing the level of execution very like the execution accomplished by the CI engine working with the fuel for which it is planned.

Elective powers from sustainable power sources without a doubt have a potential that makes them ready to react to every one of the necessities postured by CI engine s, end clients of street vehicles, and in addition the legitimate

arrangements identified with natural security. Nonetheless, because of the framework that is still ineffectively created, and due to the costly innovation of generation, it is exceptionally hard to accept that such fuel will abandon an elective fuel to customary fuel without national and global motivating forces.

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